A Description Language for Dynamic Epistemic Actions, Proceedings of the 2002 annual conference of the Australasian Association of Logic (AAL 2002)

Kooi, Barteld; van Ditmarsch, Hans; van der Hoek, Wiebe

Published in:
The Bulletin of Symbolic Logic

Publication date:
2003

THE BULLETIN OF SYMBOLIC LOGIC
Volume 9, Number 2, June 2003

2002 ANNUAL CONFERENCE OF THE AUSTRALASIAN ASSOCIATION FOR LOGIC

CO-SPONSORED BY THE ASSOCIATION FOR SYMBOLIC LOGIC

Canberra, Australia, November 30–December 2, 2002

The 2002 Annual Conference of the Australasian Association for Logic took place in Canberra, Australia on November 30–December 2, 2002. The program comprised a one hour invited talk and 18 contributed talks of 40 minutes length each. The visit of the invited speaker Mariangiola Dezani-Ciancaglini from the University of Torino was made possible by the financial support of the other sponsor of the conference, the Computer Sciences Laboratory of the Australian National University. Participants of the conference came from five countries: the US, Italy, the Netherlands, New Zealand and Australia. The last day of the conference was run in conjunction with the Australasian Workshop on Computational Logic. The aim of bringing the two meetings together for a day was to encourage communication and cooperation between researchers who have different backgrounds but overlapping interests.

Abstracts of the invited and contributed talks that were presented at the conference follow.

Conference Organizer
KATALIN BIMBÓ

Abstract of invited talk

▶ MARIANGIOLA DEZANI-CIANCAGLINI, *Finitary logical semantics*.
Università di Torino, Dipartimento di Informatica, Corso Svizzera 185, 10149 Torino, Italy.
E-mail: dezani@di.unito.it.

Stone dualities allow to describe special classes of topological spaces by means of (possibly finitary) partial orders. Typically, these partial orders are given by the topology, a basis for it, or a subbasis for it. The seminal result is the duality between the categories of Stone spaces and that of Boolean algebras (see [4]). Other very important examples are the descriptions of *Scott domains* as *information systems* [5] and the description of *SFP domains* as *pre-locales* [1]. Intersection types can be viewed also as a restriction of the domain theory in logical form, see [1], to the special case of modeling pure lambda calculus by means of ω-algebraic complete lattices. Intersection types have been used as a powerful tool both for the analysis and the synthesis of λ-models, see *e.g.*, [2]. On the one hand, intersection type disciplines provide finitary inductive definitions of interpretation of λ-terms in models. On the other hand, they are suggestive for the shape the domain model has to have in order to exhibit certain properties [3].

[1] S. ABRAMSKY, *Domain theory in logical form*, ***Annals of Pure and Applied Logic***, vol. 51 (1991), pp. 1–77.

1079-8986/03/0902-0012/$1.90

[2] M. Coppo, M. Dezani-Ciancaglini, F. Honsell and G. Longo, *Extended type structures and filter lambda models*, ***Logic colloquium '82***, North-Holland, Amsterdam, 1984, pp. 241–262.

[3] M. Dezani-Ciancaglini, F. Honsell, and Y. Motohama, *Compositional characterization of λ-terms using intersection types*, In ***Mathematical Foundations of Computer Science 2000***, vol. 1893 of ***Lecture Notes in Computer Science***, Springer, Berlin, 2000, pp. 304–313.

[4] P. T. Johnstone, ***Stone spaces***, Cambridge University Press, Cambridge, 1986.

[5] D. S. Scott, *Domains for denotational semantics*, In ***Ninth International Colloquium on Automata, Languages and Programming***, vol. 140 of ***Lecture Notes in Computes Science***, Springer, Berlin, 1982, pp. 577–613.

Abstracts of contributed talks

► KATALIN BIMBÓ, *Equational dual and symmetric combinatory logics*.
Automated Reasoning Group, CSL, RSISE, Institute of Advanced Studies, Australian National University, Bld. #115, Canberra, Australian Capital Territory 0200, Australia.
E-mail: `bimbo@csl.anu.edu.au`.

Dual combinators and symmetric λ-calculus were introduced in [3] and in [1]. It is known that the equational logic based on analogues of a combinatorially complete set of combinators yield triviality in both cases. We define two classes of equational logics, one that includes identity combinators, another that lacks identities (as primitive or defined combinators). We also consider the result of adding a rule of extensionality to these logics. Although all of these logics are known not to have the diamond property, we prove that all of them are consistent.

We give algebraic and set theoretical semantics for each of these logics. In the latter case, we provide both relational and operational semantics, and we analyze how they relate to each other. For all the logics soundness and completeness is proven with respect to the corresponding semantics.

[1] F. Barbanera and S. Berardi, *A symmetric lambda calculus for classical program extraction*, ***Information and Computation***, vol. 125 (1996), pp. 103–117.

[2] H. B. Curry and R. Feys, ***Combinatory Logic***, vol. I, North-Holland, Amsterdam, 1958.

[3] J. M. Dunn and R. K. Meyer, *Combinators and structurally free logic*, ***The Logic Journal of IGPL***, vol. 4 (1997), pp. 505–537.

► ROSS T. BRADY, *Normalized natural deduction systems for some quantified relevant logics*.
Philosophy Program, La Trobe University, Bundoora, Victoria 3086, Australia.
E-mail: `ross.brady@latrobe.edu.au`.

In the study of relevant logics, normalized natural deduction is the one area that has not been extensively studied. My paper [1] provided natural deduction systems for a wide range of (quantified) relevant logics, but they were not of the stylized form that normalization provides.

The advantage of normalization is that one can prove a Subformula Property, which usually yields Decidability together with other results (conservative extensions, degree restrictions, etc.) that flow from the inductive character of the introduction and elimination rules for the connectives and quantifiers. For quantification, I will distinguish between constrained and unconstrained variables to expedite the inductive characterization.

The normalization is an improvement on the one presented in Wellington last year and I cover the sentential relevant logic DW and its quantified extension DWQ.

[1] R. T. BRADY, *Natural deduction systems for some quantified relevant logics*, ***Logique et Analyse***, vol. 108 (1984), pp. 355–377.

▶ JOHN N. CROSSLEY, *Structures with features and time*.
School of Computer Science and Software Engineering, Monash University, Clayton, Victoria 3800, Australia.
E-mail: jnc@mail.csse.monash.edu.au.

What do we look at first when checking a proof? What is important in recognizing someone's face? What are the important things that make us realize we are looking at a (mathematical) graph? How do we look at a building? How do pilots navigate safely while using such complicated instrument panels?

These are all examples involving *structures with features*. The concept seems to arise in very many different contexts but not to have been formalized until the author's earlier paper [1]. This is true despite the use of *Feature Set Theory* by cognitive psychologists and *Design Patterns* by the architect Christopher Alexander in the mid-seventies and the Gang of Four object-oriented programmers in the 1990s.

In [1] we used the above examples to suggest how features are important in the process of abstraction from known structures, and how and when formal descriptions correspond to the world. However, since people's faces alter over time, and, in general, structures interact with each other and thereby change, it is necessary to include some time parameter.

In this paper we begin the development of a descriptive language which extends our earlier work to include some acknowledgement of time and its rôle.

We consider the operations of modifying, adding and deleting features in a structure, and interactions between structures with features. In particular we look at the question of what it means for (classes of) structures with features to be equivalent and to what extent we can actually determine whether two given structures are equivalent.

[1] J. N. CROSSLEY, *Structures with features*, manuscript, (available at http://www.csse.monash.edu.au/~jnc/features.{pdf,ps}.)

▶ GUIDO GOVERNATORI AND ANTONINO ROTOLO, *De re modal semantics*.
School of ITEE, The University of Queensland, Brisbane, Queensland 4072, Australia.
E-mail: guido@itee.uq.edu.au.
CIRSFID, University of Bologna, via Galliera 3, 40121, Italy.
E-mail: rotolo@cirfid.unibo.it.

Any quantified modal logic with the world-relative interpretation presents important questions about the treatment of *de re* modalities when a term does not refer to an existing individual. We provide a system of quantified modal logic that overcomes them. This result is achieved, semantically, with a dual quantification (one for terms not bound by modal operators, and one for terms not modally bound) and with the help of positive and negative extension (interpretation) of predicates.

Kripke frames are extended with: a function $d\colon W \mapsto 2^D$ which assigns to each world its domain; $\veebar(\phi, w_i) \subseteq d(w_i)^n$ and $\barwedge(\phi, w_i) \subseteq D^n$, respectively, the positive extension and the negative extension of a predicate ϕ w.r.t. a given world; a set F of partial (ostension) functions $f\colon W \times \mathfrak{C} \mapsto D$. $\veebar$ and $\barwedge$ satisfy the following conditions:

1. If $\vec{d} \in \veebar(\phi, w_i)$ then $\vec{d} \notin \barwedge(\phi, w_i)$;
2. $\forall c\colon f(w_i, c) = d \in d(w_i)$, if $\vec{d} \notin \veebar(\phi, w_i)$ then $\vec{d} \in \barwedge(\phi, w_i)$.

The idea behind negative and positive extension of a predicate ϕ is that ϕ is believed to be true until a counterexample is provided, i.e., until an element does not belong to the negative extension. Given a model M, the notion of a formula α *being true in M at w_i*, $\models^M_{w_i} \alpha$ contains the following clauses:

1. $\models^M_{w_i} \phi(c)$ iff (1) $f(w_i, c) \in d(w_i)$ and $f(w_i, c) \in \underline{\vee}(\phi, w_i)$, or
   (2) $f(w_i, c) \notin d(w_i)$ and $f(w_i, c) \notin \overline{\wedge}(\phi, w_i)$;
2. $\models^M_{w_i} \forall x(\gamma(x)\#\Box\delta(x))$ iff $\forall c_h, c_k, w_j$ if $w_i R w_j$, $f(w_j, c_h) \in d(w_j)$ and $f(w_j, c_h) = f(w_i, c_k)$, then $\models^M_{w_i} \gamma(c_k/x)\#\Box\delta(c_h/x)$.

In this way quantifiers establish the range of quantification with respect to a modality. Open and objective formulas are evaluated in the whole domain, whereas *de re* formulas take care only of the individuals in the valuation of actual world(s) domain(s).

▶ SVEN HARTMANN, *Inference rules for participation constraints*.
Department of Information Systems and Information Science Research Centre, Massey University, Palmerston North, New Zealand.
E-mail: s.hartmann@massey.ac.nz.

Database constraints are used to express the properties that a database must respect to plausibly represent the underlying section of reality. Participation constraints are among the most popular constraint classes available in semantic database models as for example the higher-order entity relationship model [2]. They impose restrictions on the number of times objects of a certain type may participate in relationships of certain types.

In our talk we discuss recent results on the implication problem for participation constraints continuing earlier work in this area [1]. Special attention is devoted to generalized participation constraints limiting the occurrence of combinations of various objects.

We present a sound and complete system of inference rules for the class of participation constraints and provide a characterization of closed constraint sets. Finally, we point out that implication and finite implication do not coincide for participation constraints.

[1] S. Hartmann, *On the implication problem for cardinality constraints and functional dependencies*, ***Annals of Mathematics and Artificial Intelligence***, vol. 33 (2001), pp. 253–307.

[2] B. Thalheim, *Foundations of entity-relationship modeling*, ***Annals of Mathematics and Artificial Intelligence***, vol. 6 (1992), pp. 197–256.

▶ LLOYD HUMBERSTONE, *Béziau's paradox*.
Department of Philosophy, School of Philosophy, Linguistics and Bioethics, Monash University, P.O. Box 11a, Clayton, Victoria 3800, Australia.
E-mail: lloyd.humberstone@arts.monash.edu.au.

Jean-Yves Béziau in [1] has given an especially clear example of what he considers a phenomenon sufficiently puzzling to call the 'paradox of translation': the case of one logic being strictly weaker than another and yet such that the stronger logic can be embedded (faithfully) in it *via* a definitional translation. We elaborate on Béziau's example, which concerns classical negation, as well as give some additional background (especially from intuitionistic logic) to the example, and finally consider whether such examples should be found puzzling.

[1] J.-Y. Béziau, *Classical negation can be expressed by one of its halves*, ***The Logic Journal of the IGPL***, vol. 7 (1999), pp. 145–151.

▶ BARTELD KOOI, HANS VAN DITMARSCH AND WIEBE VAN DER HOEK, *A description language for dynamic epistemic actions*.
University of Groningen, Computing Science, P.O. Box 800, 9700 AV Groningen, The Netherlands.
E-mail: barteld@cs.rug.nl.
Department of Computer Science, University of Otago, P.O. Box 56, Dunedin, New Zealand.
E-mail: hans@cs.otago.ac.nz.

In our paper we develop a dynamic epistemic logic that allows partial descriptions of actions. In most dynamic epistemic logics an entire description of an action is required, even when one is only interested in some features of the action. Let us first explain what dynamic epistemic logic is, and why such a logic is worthwhile.

Epistemic logic is a modal logic used to reason about information. It deals with information of many agents, including information they have about each other. In this way epistemic logic also deals with *higher order information*. However, it does not deal with information change. Dynamic epistemic logics are extensions of epistemic logic that deal with information change. Several systems have been proposed, notably those by [2], [1], [5], and more recent work by [4] combining hybrid logic with multidimensional logic and epistemic logic, and [3] combining probabilistic logic with dynamic epistemic logic.

In dynamic epistemic logic, incorporating information is called updating. It should not be confused with the notion of updating in the belief revision paradigm. The simplest example is where an agent learns that a sentence holds. But there are much more complicated forms, where different agents have different access to the information and the information the agents have about each other also plays a role.

In our paper we define multi-agent static and action models and show how to execute an action model in a static model based on [1]. We define a static and an action language that can be interpreted in the static and action models, respectively. Moreover a dynamic language is introduced which is a mix of the static and action languages. A proof system that is as of yet incomplete is also provided. Some of the difficulties of devising a complete proof system are discussed.

[1] A. Baltag, L. S. Moss and S. Solecki, *The logic of public announcements, common knowledge, and private suspicions*, ***Technical report***, SEN-R9922, CWI, Amsterdam, 1999.

[2] J. Gerbrandy and W. Groeneveld, *Reasoning about information change*, ***Journal of Logic, Language, and Information***, vol. 6 (1997), pp. 147–196.

[3] B. P. Kooi, *Probabilistic dynamic epistemic logic*, manuscript, 2002, (available at `http://www.cs.rug.nl/~barteld/`.).

[4] B. D. ten Cate, *Internalizing epistemic actions*, In M. Martinez (ed.) ***Proceedings of the NASSLLI 2002 student session***, 2002, pp. 109–123.

[5] H. P. van Ditmarsch, ***Knowledge Games***, (ILLC Dissertation Series DS-2000-06), Amsterdam, 2000.

► SEBASTIAN LINK, *Capturing dependency classes in conceptual databases*.
Massey University, Department of Information Systems, Palmerston North, New Zealand.
E-mail: `s.link@massey.ac.nz`.

The theory of databases has widely been the theory of the relational database model. In this context, sound and complete sets of inference rules for the implication of functional and multivalued dependencies are well-known ([1], [2]).

This paper investigates finite axiomatizability of functional and multivalued dependencies in the higher-order entity-relationship model introduced in [3].

It is demonstrated that the set of subattributes of a given nested attribute carries the structure of a Heyting Algebra. Sound and complete sets of inference rules in Hilbert style are identified for the families of functional dependencies and both functional and multivalued dependencies, generalizing the results from [1] and [2], respectively.

[1] W. W. Armstrong, *Dependency structures of data base relationships*, ***Information Processing 74***, North-Holland, Amsterdam, 1974, pp. 580–583.

[2] C. Beeri, R. Fagin and J. H. Howard, *Acomplete axiomatization for functional and multivalued dependencies in database relations*, ***International Conference on Management of Data***, ACM-SIGMOD, 1977, pp. 47–61.

[3] B. Thalheim, *Foundations of entity-relationship modeling*, ***Annals of Mathematics and Artificial Intelligence***, vol. 6 (1992), pp. 197–256.

▶ CASEY N. MCGINNIS, *Some of the best worlds are impossible: semi-paraconsistent deontic logic and its motivation.*
Department of Philosophy, University of Minnesota, Twin Cities, Minneapolis, Minnesota 55455, USA.
E-mail: `mcgin017@umn.edu`.

A *quandary* is a situation in which a state of affairs is obligatory and forbidden. Classical deontic logic (CDL) cannot handle quandaries, as it validates the principle of *deontic explosion*, according to which if *anything* is obligatory and forbidden then *everything* is. Paraconsistent deontic logic (PDL) can handle quandaries, as it invalidates deontic explosion; however, it faces a serious drawback, namely, that it forces the rejection of disjunctive syllogism (or some even more intuitive logical principle). In this paper I introduce a "semi-paraconsistent" deontic logic (SPDL) which rejects deontic explosion, but preserves disjunctive syllogism (and indeed all of classical propositional logic), thus occupying a pleasing middle ground between CDL and PDL. Against the objection that SPDL is an *ad hoc* construction, I argue that it is a natural expression of some independently defensible assumptions about the notion of a "deontically perfect" world.

▶ ROBERT K. MEYER, *Combinators, relevance and types-as-formulae.*
National ICT Australia, Automated Reasoning Group, RSISE, Bld. #115, Australian National University, Canberra, Australia.
E-mail: `bob.meyer@anu.edu.au`.

By the *Key to the Universe*, we mean the satisfying correspondence between candidate *axioms* for relevant and other logics and *combinators*. Roughly, the axioms are the *types* assigned by Curry in [1] to these combinators in his illative Combinatory Logic (henceforth, **CL**). Magically, the postulates set down for such axioms in the relational semantics for substructural logics (e.g., in [2]) have the *shape* of the corresponding combinators. The formal ground of this magic was glimpsed in [3] and worked out (for the related λ-calculus **LC**) in [4]—there are *models* of **CL** in logical *theories*. But the Key to the Universe needs *sharpening*. Viewed logically, the *good* model of [4] does without disjunction and negation. Yet relevant semantical soundness and completeness proofs accommodate these particles smoothly. By climbing a set-theoretic level—from sets of formulae (level 1) to sets of sets of formulae (level 2)—we show how to represent the combinators better in this work.

[1] H. B. CURRY and R. FEYS, ***Combinatory Logic***, vol. I, North-Holland, Amsterdam, 1958.

[2] R. ROUTLEY and R. K. MEYER, *The semantics of entailment III*, ***Journal of Philosophical Logic***, vol. 1 (1972), pp. 192–208.

[3] R. K. MEYER, M. W. BUNDER and L. POWERS, *Implementing the 'Fool's model' of combinatory logic*, ***Journal of Automated Reasoning***, vol. 7 (1991), pp. 597–630.

[4] H. BARENDREGT, M. COPPO and M. DEZANI-CIANCAGLINI, *A filter lambda model and the completeness of type assignment*, ***The Journal of Symbolic Logic***, vol. 48 (1983), pp. 931–940.

▶ CHRIS MORTENSEN AND PETER QUIGLEY, *Cubic logic, Ulam games and paraconsistency.*
Philosophy Department, University of Adelaide, Adelaide, South Australia 5005, Australia.
E-mail: `cmortens@arts.adelaide.edu.au`.
E-mail: `peter.quigley@student.adelaide.edu.au`.

Ulam Games are series of 20 questions in which one or more lies are permitted. Mundici showed that these can be decided using Łukasiewicz Logics, with the number of lies permitted determining the number of values of the Logic. It was also shown that Rota-Metropolis Cubic models are characteristic for the game with 1 lie. In the present paper two things are done: (1) the result is extended to the general case with more than 1 lie, and (2) Mundici's claim that paraconsistent negation is involved is analysed and shown to be correct in part.

[1] F. Cicalese, D. Mundici and U. Vaccaro, *Rota-Metropolis cubic logic and Ulam-Rényi games*, In D. Senato and H. Crapo (eds.) ***Algebraic combinatorics and computer science: a tribute to Gian-Carlo Rota***, Springer-Italia, Milan, 2001, pp. 197–244.

▶ GREG RESTALL, *What shapes can proofs be?*
Philosophy Department, University of Melbourne, Parkville, Victoria 3010, Australia.
E-mail: `restall@unimelb.edu.au`.

Natural deduction proof systems are elegant, powerful and, as the name says, natural. Different constraints on the structure and shape of proofs give rise to different logics. In this talk I will sketch some of the known results about different systems of natural deduction, present some original results, and indicate why they are interesting from both computational and philosophical perspectives.

▶ SUSAN ROGERSON, *Investigations into the properties of structural rules on the right*.
Department of Philosophy, School of Philosophy, Linguistics and Bioethics, Monash University, P.O. Box 11a, Clayton, Victoria 3800, Australia.
E-mail: `su@surogerson.com`.

In his paper [1] Hirokawa shows that for a given sequent calculus formulation of first order classical logic, the structural rules of thinning on the right and contraction on the right cannot be separated; that is, any proof using n occurrences of one will also use n occurrences of the other. Hirokawa notes that his result is sensitive to the formulation. In this paper we investigate this sensitivity, both with respect to the formulations of the rules governing the connectives present and to the choice of the connectives themselves.

[1] S. Hirokawa, *Right weakening and right contraction in LK*, ***Proceedings of CATS'96***, (***Computing: The Australasian Theory Symposium***), Melbourne, Australia, January 29–30, RMIT, University of Melbourne, 1996, pp. 168–174.

▶ KLAUS-DIETER SCHEWE, *Error-robust functional dependencies*.
Massey University, Department of Information Systems and Information Science Research Centre, Private Bag 11 222, Palmerston North, New Zealand.
E-mail: `k.d.schewe@massey.ac.nz`.

A database user may be confronted with a relation that contains errors. These errors may result from transmission through a noisy channel, or they may have been added deliberately in order to hide or spoil information. Error-robust functional dependencies provide dependencies that still hold in the case of errors. We investigate the finite axiomatisation of such dependencies, and present a sound and complete system of axioms and rules for the implication of error-robust dependencies.

▶ HARTLEY SLATER, *A short lesson in logic*.
Department of Philosophy, University of Western Australia, 35 Stirling Highway, Crawley, Western Australia 6009, Australia.
E-mail: `slaterbh@cyllene.uwa.edu.au`.

I pointed out in [1] that the constant expression 'is heterological' masks the variable in 'is not self-applicable'. The latter predicate involves a reflexive pronoun, which is a constant syntactic item, but in different contexts it has a different referent. There is thus a problem with '"x" is h iff "x" is not x', because it does not respect the feature which allows there to be no problem with '"x" is non-x iff "x" is not x'. The point clearly also applies to the variable set in Russell's Paradox. What is a set a member of iff it is not a member of itself? It is a member of its complement.

What misleads is that in the lambda abstraction, and set abstraction expressions which are commonly taken to refer to properties and sets, all the variables are bound. But these abstracts are drawn from whole sentences, and it is only parts of those sentences which express the properties involved, and which relate, therefore, to any associated set. That a set is not a member of itself is not a property of it, but a truth about it, it must be remembered; and the property it then possesses is, in fact, not only context-sensitive, but also ambiguous, as I showed in [2]. What is missing in Fregean abstracts is, first of all, the indentification of a single, subject place where the variable is bound.

Confusing predicates with sentences is also present in common treatments of the Liar and related paradoxes, along with confusing sentences with thoughts. Can it be said of the sentence 'The sentence at the top of the page is false', that it is false of anything—in particular, that it is false of itself, if it is the sentence at the top of the page? No: for there is no place waiting in that sentence for the name of any thing it might be false of to be inserted. That it is false is the sort of thing which might be false of something, because 'that it is false' has a space waiting to be filled in the appropriate way. But, as a result, for that it is false to be false of itself would be for it to be false of something unspecified, since its expression contains a waiting pronoun. In fact, that it is false is false of the said sentence (no matter where it might be), because sentences are neither true nor false. What might be true or false of s is that it is P, but 'that s is P' is not a sentence, it is a noun phrase—a demonstrative referring phrase to a thought, as I explained in [3]. If the sentence at the top of the page is a Strengthened Liar, like 'The sentence at the top of the page is false, or neither true nor false', wouldn't we, contradictorily, have to say that the sentence actually there was true, since it states the facts? No: because what is true is simply that the sentence at the top of the page is false or neither true nor false, not 'the sentence at the top of the page is false or neither true nor false'

[1] B. H. Slater, *Is 'heterological' heterological?*, ***Mind***, vol. 327 (1973), pp. 439–440.

[2] B. H. Slater, *Sensible self-containment*, ***Philosophical Quarterly***, vol. 34 (1984), pp. 163–164.

[3] B. H. Slater, *Prior's analytic revised*, ***Analysis***, vol. 61 (2001), pp. 86–90.

▶ NICHOLAS J. J. SMITH, *Not quite all there: fuzzy mereology and fuzzy existence*.
Department of Philosophy and Centre for Logic, Language and Computation, Victoria University of Wellington, P.O. Box 600, Wellington, New Zealand.
E-mail: `nicholas.smith@vuw.ac.nz`.

Daveore Lewder (the fusion of David Lewis and Theodore Sider) argues that mereological composition can never be a vague matter, for if it were, then existence would sometimes be a vague matter too, and that's impossible. I accept that vague composition implies vague existence, but deny that either is impossible. In this paper I develop degree-theoretic versions of quantified modal logic and of mereology, and combine them in a framework which allows us to make clear sense of vague composition and vague existence, and the relationships between them.

▶ MATTHEW SPINKS, *On BCSK logic*.
Gippsland School of Computing and Information Technology, Monash University, Churchill, Victoria 3842, Australia.
E-mail: `mspinks@www.gscit.monash.edu.au`.

For a quasivariety K over a language $\mathcal{L}$ with a constant term $\boldsymbol{1}$, the *$\boldsymbol{1}$-assertional logic* of K, in symbols $\mathbb{S}(\mathsf{K},\boldsymbol{1})$, is the consequence relation $\vdash_{\mathbb{S}(\mathsf{K},\boldsymbol{1})}$ from sets of $\mathcal{L}$-terms to $\mathcal{L}$-terms determined by the following equivalence:

$$\Gamma \vdash_{\mathbb{S}(\mathsf{K},\boldsymbol{1})} \phi \quad \text{iff} \quad \{\psi \approx \boldsymbol{1} \colon \psi \in \Gamma\} \models_{\mathsf{K}} \phi \approx \boldsymbol{1}.$$

An *implicative BCSK-algebra* is an algebra $\langle A; \Rightarrow, \rightarrow, 1\rangle$ of type $\langle 2, 2, 0\rangle$, where for all $a, b \in A$ the operations $\Rightarrow$ and $\rightarrow$ are defined, respectively, by the following pair of conditional equalities:

$$a \Rightarrow b := \begin{cases} 1 & \text{if } a = b \\ b & \text{otherwise} \end{cases} \quad \text{and} \quad a \to b := \begin{cases} b & \text{if } a = 1 \\ 1 & \text{otherwise.} \end{cases}$$

We denote by BCSK the variety generated by the class of all implicative BCSK-algebras. *BCSK logic*, in symbols $\mathbb{BCSK}$, is the $\boldsymbol{1}$-assertional logic of the variety BCSK.

Let $\boldsymbol{A} := \langle A; \boldsymbol{1}^{\boldsymbol{A}} \rangle$ be a pointed set. The *pointed fixedpoint discriminator* on $\boldsymbol{A}$ is the function $f\colon A^3 \to A$ defined by:

$$f(a, b, c) := \begin{cases} c & \text{if } a = b \\ 1 & \text{otherwise.} \end{cases}$$

The element 1 is called the *discriminating element*. A *pointed fixedpoint discriminator variety* is a variety V with a constant term $\boldsymbol{1}$ for which there is a subclass K of V and a ternary term $f(x, y, z)$ of V such that: (i) for every $\boldsymbol{A} \in \mathsf{K}$, the term $f(x, y, z)$ realises the pointed fixedpoint discriminator on $\langle A; \boldsymbol{1}^{\boldsymbol{A}} \rangle$ with discriminating element 1; and (ii) $\mathsf{V} = \mathbf{HSP}(\mathsf{K})$. The *pure pointed fixedpoint discriminator variety*, in symbols $\mathsf{FPD}_{\boldsymbol{1}}$, is the pointed fixedpoint discriminator variety generated by the class of all algebras $\boldsymbol{A} := \langle A; f, \boldsymbol{1}^{\boldsymbol{A}} \rangle$ of type $\langle 3, 0 \rangle$, where f is the pointed fixedpoint discriminator on $\langle A; \boldsymbol{1}^{\boldsymbol{A}} \rangle$ and $\boldsymbol{1}^{\boldsymbol{A}}$ is a nullary operation. The main result of the talk is the following:

THEOREM 1. *The deductive systems* $\mathbb{BCSK}$ *and* $\mathbb{S}(\mathsf{FPD}_{\boldsymbol{1}}, \boldsymbol{1})$ *are equivalent.*

► KOJI TANAKA, *The AGM theory and inconsistent belief change.*
Philosophy Department, Macquarie University, Sydney, New South Wales 2109, Australia.
E-mail: koji.tanaka@mq.edu.au.

The problem of how to accommodate inconsistencies has attracted quite a number of researchers, in particular, in the area of database theory. The problem is also of concern in the study of belief change. For inconsistent beliefs are ubiquitous. However, comparatively little work has been devoted to discussing the problem in the literature of belief change. In this paper, I examine how adequate the AGM theory is as a conceptual and logical framework for belief change involving inconsistencies. The technique is to apply to Grove's sphere system, a semantical representation of the AGM theory, logics that do not infer everything from contradictory premises, *viz.*, paraconsistent logics. I use three paraconsistent logics and discuss three sphere systems that are based on them. I then examine the completeness of the postulates of the AGM theory with respect to the systems. At the end, I discuss some philosophical implications of the examination.